

REMARKS

Claims 1, 4-11 and 13-23 are pending in this application. By this Amendment, claims 1, 13, 14, 16 and 22 are amended, claim 2 is canceled, and claim 23 is added. No new matter is added.

The Office Action rejects claim 14 under 35 U.S.C. §112, first paragraph. This rejection is respectfully traversed.

Claim 14 is amended to clarify the dimensions of the first and second portions with respect to the main sapphire substrate body and to each other. Claim 14 is also amended to depend from claim 1 because of an incompatibility with claim 13. Claims 13 and 16 are also amended to remedy antecedent support by deleting the "body has a thickness" feature because this feature is already positively recited in claim 1.

Support for the changes to claim 14 are found, for example, in Fig. 3 and paragraphs [0044] and [0045]. Claim 14 is thus fully supported by and enabled by Applicants' specification. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claim 14 under 35 U.S.C. §112, second paragraph. This rejection is respectfully traversed.

Claim 14 is amended to conform to Fig. 3 and recites that the first portion has thickness less than the thickness of the body and the second portion has a thickness equal to the body. Claim 14 is thus concise and definite. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claims 1-2, 6-7, 11, 13, 15 and 18-20 under 35 U.S.C. §103(a) over newly cited U.S. Patent No. 6,593,159 to Hashimoto et al. (Hashimoto) in view of U.S. Patent No. 6,239,033 to Kawai and CRC Handbook of Chemistry and Physics, 82nd Ed. by David Lide (Lide). This rejection is respectfully traversed.

The Office Action bases the rejection on the combination of newly cited Hashimoto with the teachings of the previously applied references. Particularly, the Office Action alleges that Hashimoto has a sapphire substrate body 60 with a cavity 68 and a semiconductor structure disposed over the cavity. Although the Office Action admits that Hashimoto fails to teach a filling of the cavity, the Office Action alleges that it would have been obvious to substantially fill Hashimoto's empty cavity recess 68 with a material having a greater thermal conductivity than the sapphire substrate body, based on the teachings of Kawai and Lide. Applicants respectfully disagree. This specific suggested combination is both unpractical and non-obvious from the teachings of the references. In particular, the Patent Office fails to establish motivation for the alleged combination and therefore fails to establish a *prima facie* case of obviousness.

The purpose of Hashimoto is to decrease threading dislocations and cracks inside the semiconductor device structure so as to lengthen the lifetime of the device. To achieve this goal, a recess/cavity is formed within the sapphire substrate, opening toward the bottom of the surface, so that the thickness of the sapphire substrate is smaller than or substantially equal to the thickness of the semiconductor layer. The recess in the sapphire substrate directs the threading dislocations and cracks towards the sapphire substrate and therefore decreases the threading dislocations and cracks in the semiconductor structure, to lengthen the lifetime of the device (col. 2, line 56 to col. 3, line 8, Fig. 8 and col. 12, lines 59 to col. 13, line 6).

The empty recess/cavity 68 in Hashimoto is critical to its operation and is not taught to serve as a heat sink. Therefore, Hashimoto teaches away from filling it with any kind of material as alleged and clearly does not suggest the use alleged by the Office Action.

The Office Action and Advisory Action fail to read Hashimoto "as a whole" and fail to properly consider this "teaching away" evidence, as required by MPEP §2142.02(VI).

Moreover, to proceed as the Office Action suggests would obviate the main purpose of Hashimoto, rendering it unsuitable for its intended purpose. As set forth in MPEP §2143.01(VI), such impermissible modifications do not render a combination *prima facie* obviousness. Thus, because there is no motivation or suggestion to combine the references as alleged from the Hashimoto teachings, the requirements for a *prima facie* case of obviousness has not been met.

Kawai fails to overcome the deficiencies of Hashimoto. Kawai teaches advantages to "thinning" of the substrate, which also teaches away from the subject matter of independent claim 1, which can use a thick substrate and a cavity-filled heatsink. As previously asserted in Applicants' prior response, Kawai is concerned with providing electrical conductivity by its electrode structure. Although having limited heat dissipation properties, Kawai does not appreciate advantages to sizing of the cavity as claimed and instead relies upon a small hole for electrical conduction and the "thinned" substrate for most heat dissipation. Thus, even if combined, the combination fails to teach or suggest the specific configuration recited.

Lide is only relied upon for identification of gold (Au) as having high thermal conductivity properties. However, Lide fails to appreciate problems overcome by the subject matter of claim 1 and fails to teach or suggest filling the cavity as claimed and forming the cavity as claimed.

Independent claim 1 and the claims dependent therefrom thus define over the alleged combination and are allowable. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claims 4-5 and 21-22 under 35 U.S.C. §103(a) over Hashimoto in view of Kawai and Lide, further in view of U.S. Patent No. 5,059,763 to O'Brien. This rejection is respectfully traversed.

O'Brien fails to overcome the deficiencies of Hashimoto et al. with respect to independent claim 1. O'Brien is merely relied upon for laser ablation, but does not relate to a semiconductor layer such as sapphire. Thus, O'Brien does not recognize problems facing such a layer.

Moreover, with respect to claim 22, Kawai teaches in Fig. 11 to form a through hole entirely through the substrate to make contact. Claim 22 specifies that the cavity does not open in the top. Thus, Kawai teaches away from the alleged combination.

Accordingly, claims 4-5 and 21 are allowable for their dependence on allowable base claim 1 and for the additional features recited therein. Independent claim 22 is similarly allowable. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claims 8-9 under 35 U.S.C. §103(a) over Hashimoto in view of Kawai and Lide, further in view of U.S. Patent No. 5,731,046 to Mistry et al. This rejection is respectfully traversed.

Mistry fails to overcome the deficiencies of Hashimoto et al. with respect to independent claim 1. Accordingly, claims 8-9 are allowable for their dependence on allowable base claim 1 and for the additional features recited therein. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claim 10 under 35 U.S.C. §103(a) over Hashimoto in view of Kawai and Lide, further in view of U.S. Patent No. 6,189,771 to Maeda. This rejection is respectfully traversed.

Maeda fails to overcome the deficiencies of Hashimoto et al. with respect to independent claim 1. Accordingly, claim 10 is allowable for its dependence on allowable base claim 1 and for the additional features recited therein. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claims 14 and 16-17 under 35 U.S.C. §103(a) over Hashimoto in view of Kawai and Lide, further in view of U.S. Patent No. 5,449,930 to Zhou. This rejection is respectfully traversed.

Zhou fails to overcome the deficiencies of Hashimoto et al. with respect to independent claim 1. Zhou is relied upon for having a cavity with a depth equal to the thickness of the body. However, the Office Action fails to provide a motivation for replacing the isolated cavity in Hashimoto with a structure in Zhou that has a through opening. Moreover, Zhou is directed to a GaAs structure, not a sapphire body. Sapphire is a much harder substrate with different properties. Also, as mentioned previously, the empty cavity 68 in Hashimoto is specifically provided to prevent thread dislocations. Thus, Hashimoto teaches a criticality to the empty cavity, which is incompatible with the structure in Zhou. Accordingly, Hashimoto and Zhou are not combinable as alleged. Thus, claims 14 and 16-17 are allowable for their dependence on allowable base claim 1 and for the additional features recited therein. Withdrawal of the rejection is respectfully requested.

Claim 23 is added. Claim 23 adds that the body thickness is at least about 100 μm . This is supported, for example, by paragraph [0006] and Fig. 16. As mentioned above with respect to claim 1, Kawai teaches advantages to "thinning" of the substrate, which teaches away from use of a thicker substrate.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of pending claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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Attachment:

Request for Continued Examination
Petition for Extension of Time

Date: August 14, 2006

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